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Shin

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(54) **ANGLE ADJUSTABLE EAR JACK DEVICE**

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H01R 13/60 (2006.01)
H01R 24/58 (2011.01)
H01R 35/04 (2006.01)

(52) **U.S. Cl.**
CPC ***H01R 13/60*** (2013.01); ***H01R 24/58*** (2013.01); *H01R 35/04* (2013.01)

(58) **Field of Classification Search**
CPC H01R 29/00; H01R 13/518; H01R 24/58; H01R 23/025
USPC 439/170, 534, 668, 669, 954
See application file for complete search history.

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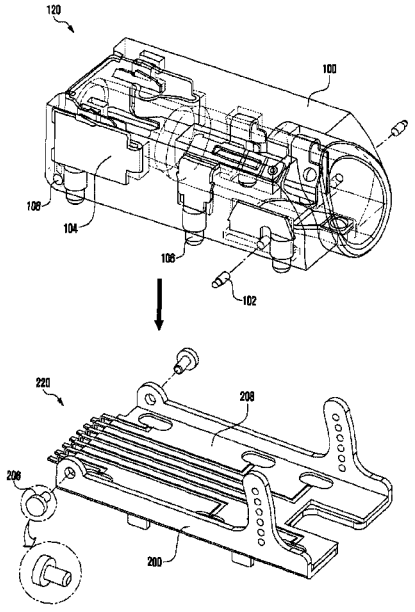
(57) **ABSTRACT**

An ear jack device capable of adjusting an angle of the ear jack is provided. The angle adjustable ear jack device includes an ear jack unit capable of an angle adjustment, an ear jack support unit for adjusting the angle of the ear jack unit, and at least one hinge for assembling the ear jack unit and the ear jack support unit.

18 Claims, 14 Drawing Sheets



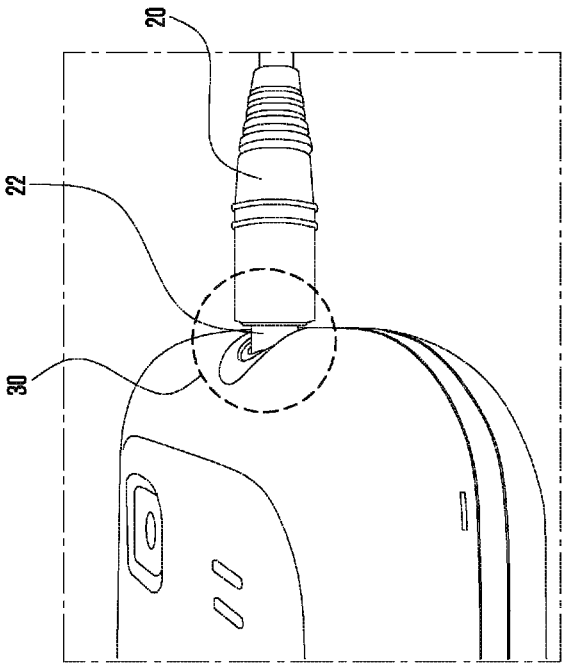


FIG. 1B

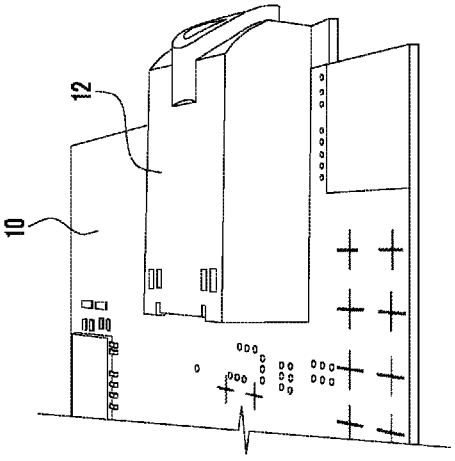


FIG. 1A

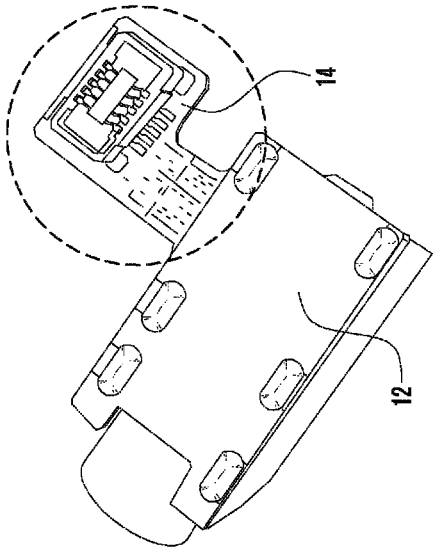


FIG. 2B

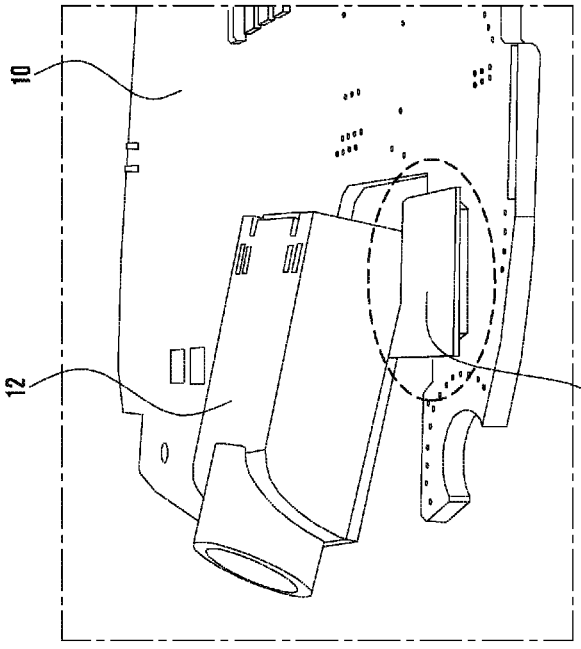


FIG. 2A

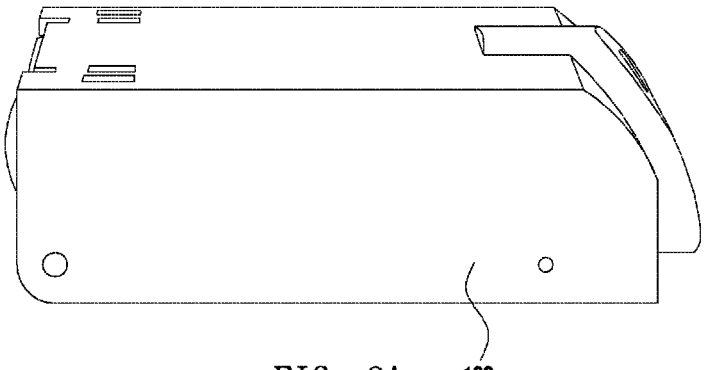


FIG. 3A

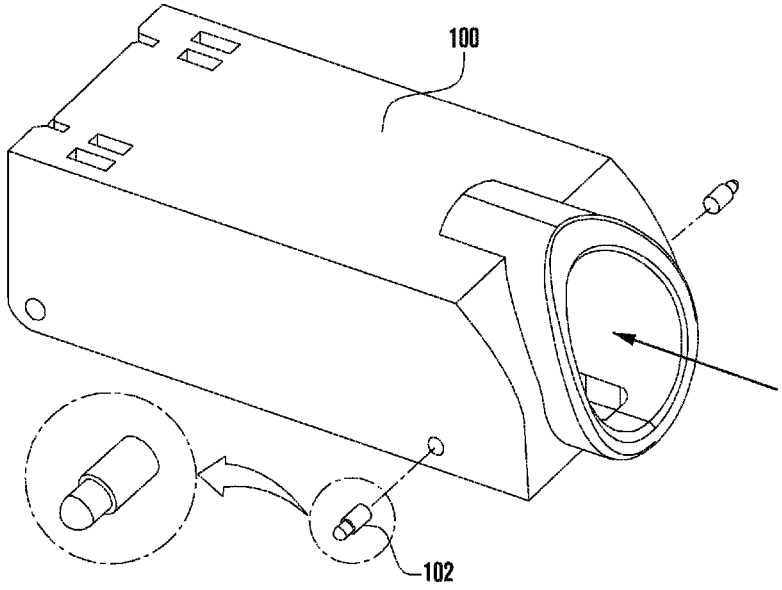


FIG. 3B

FIG. 4

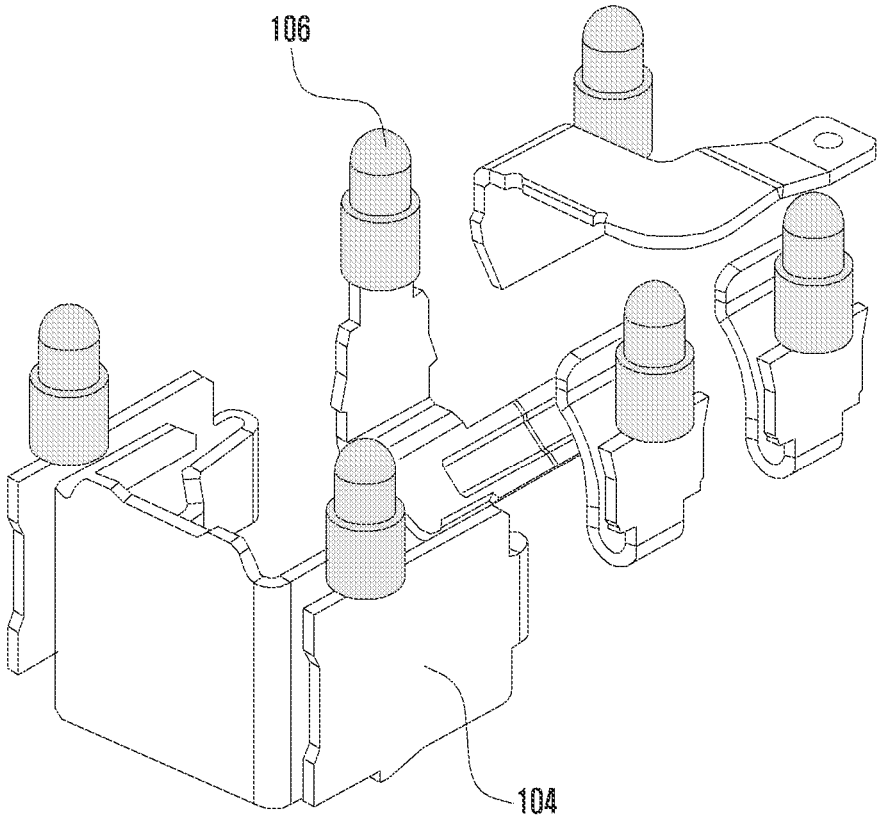
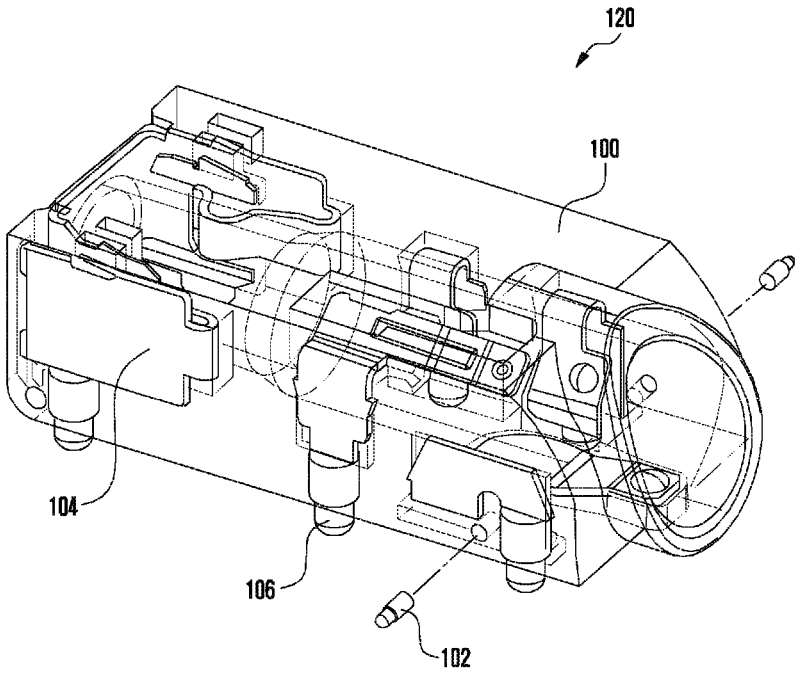


FIG. 5



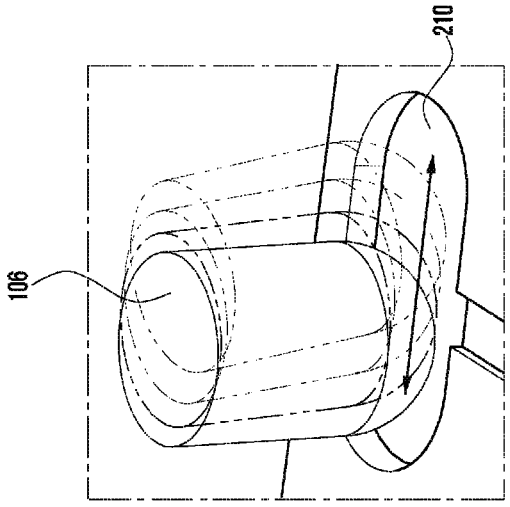


FIG. 6B

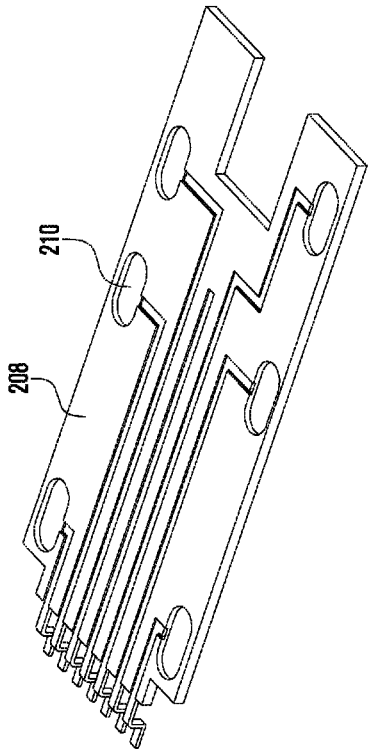


FIG. 6A

FIG. 7

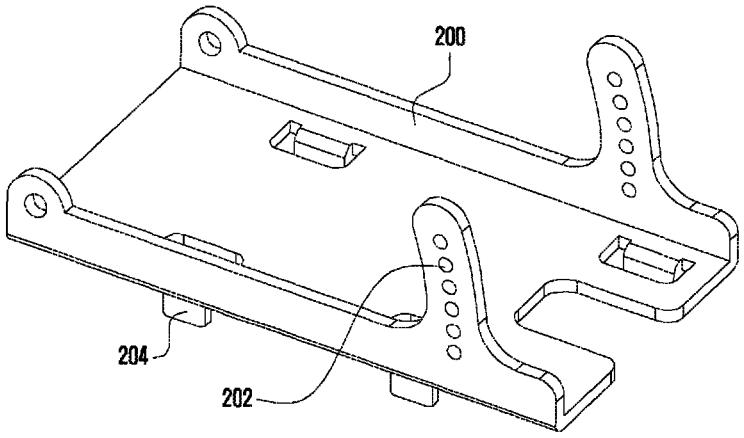
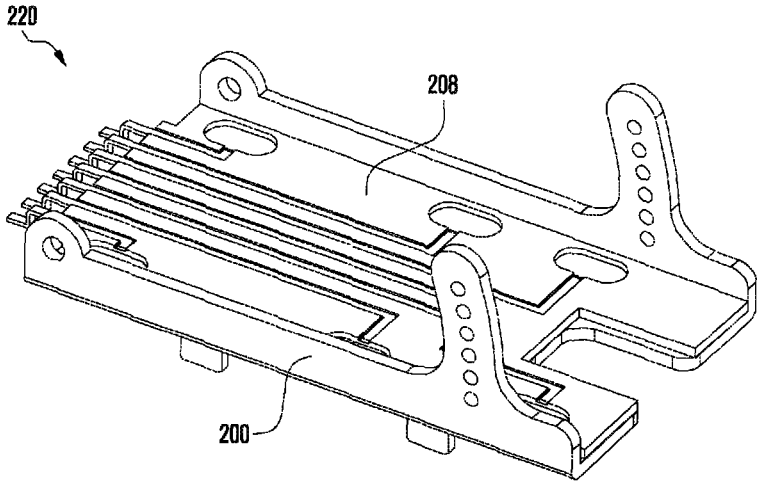


FIG. 8



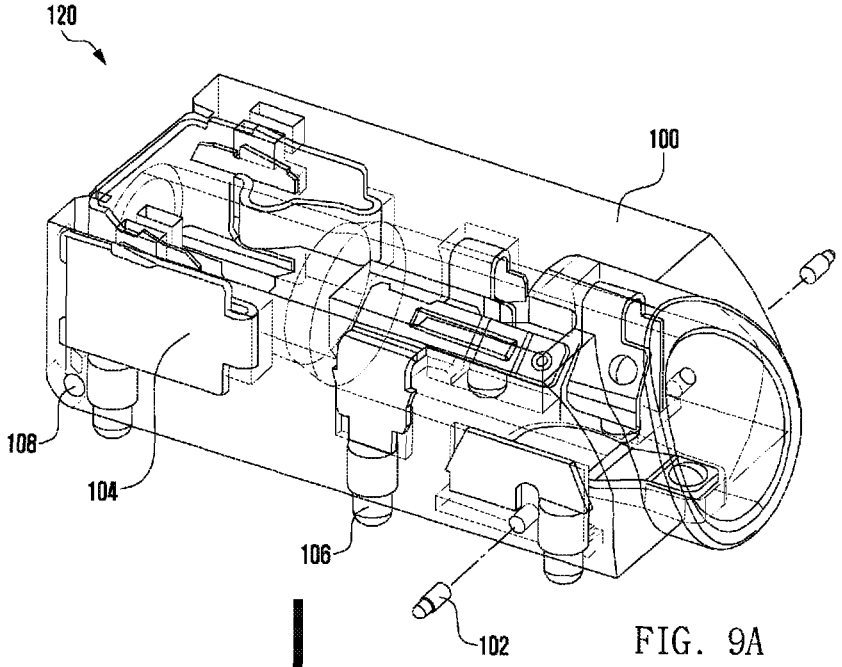


FIG. 9A

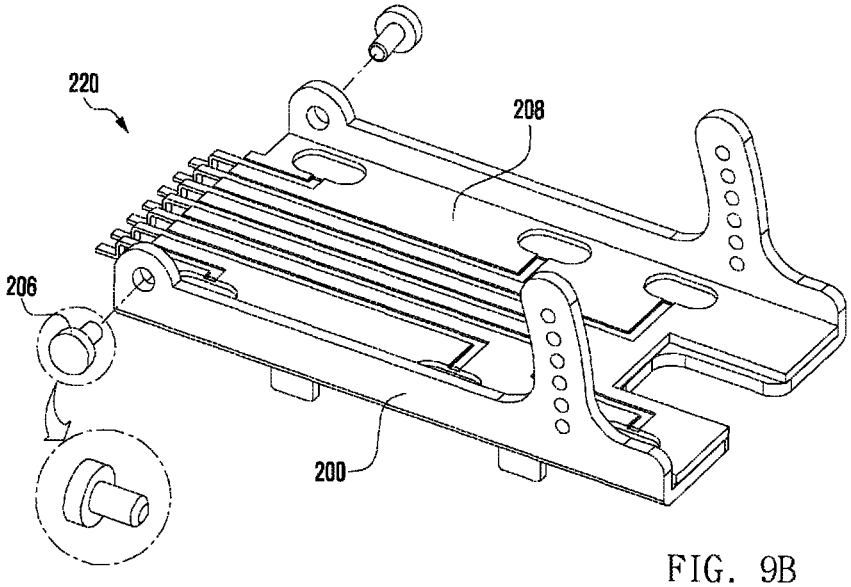
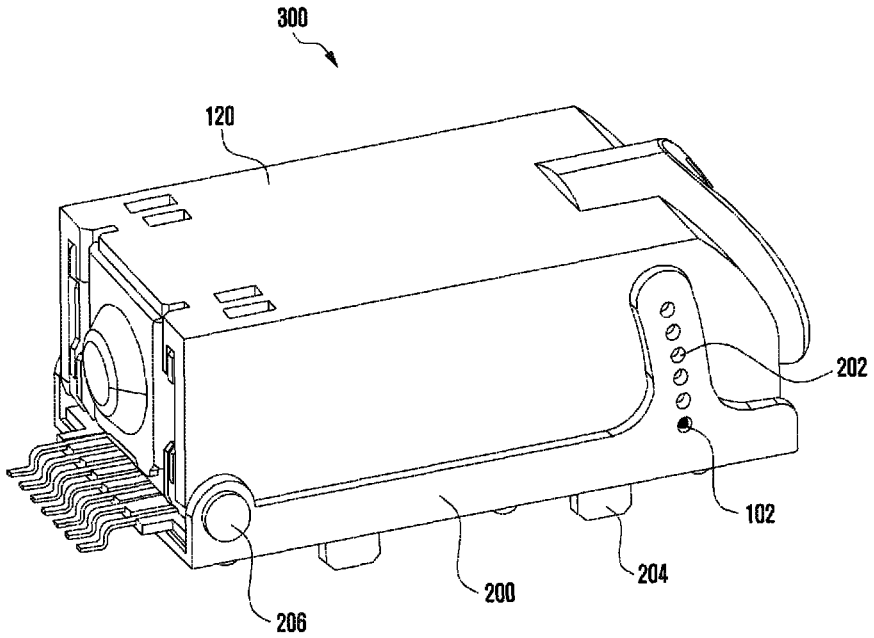


FIG. 9B

FIG. 10



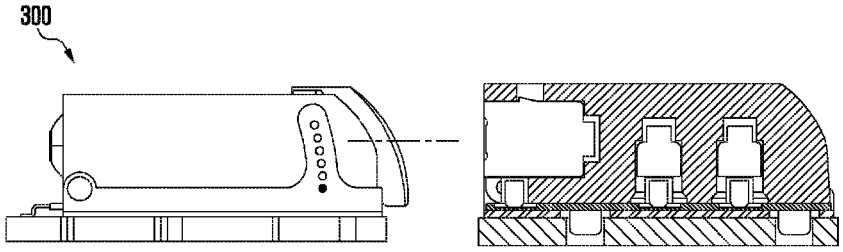


FIG. 11A

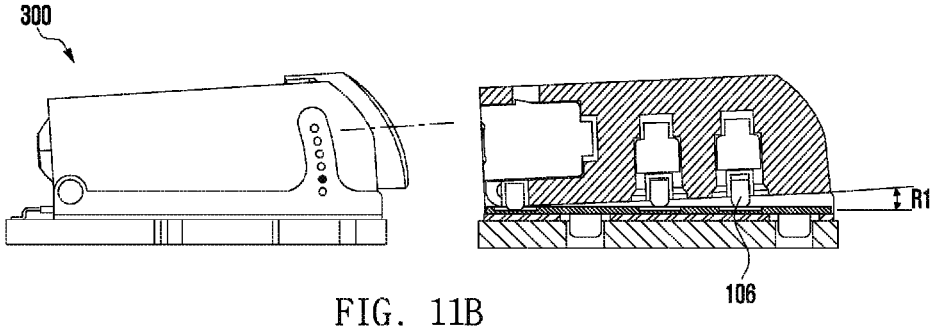


FIG. 11B

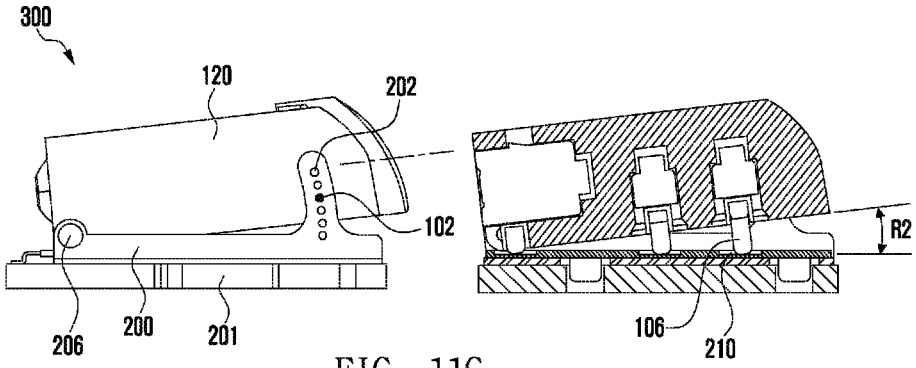


FIG. 11C

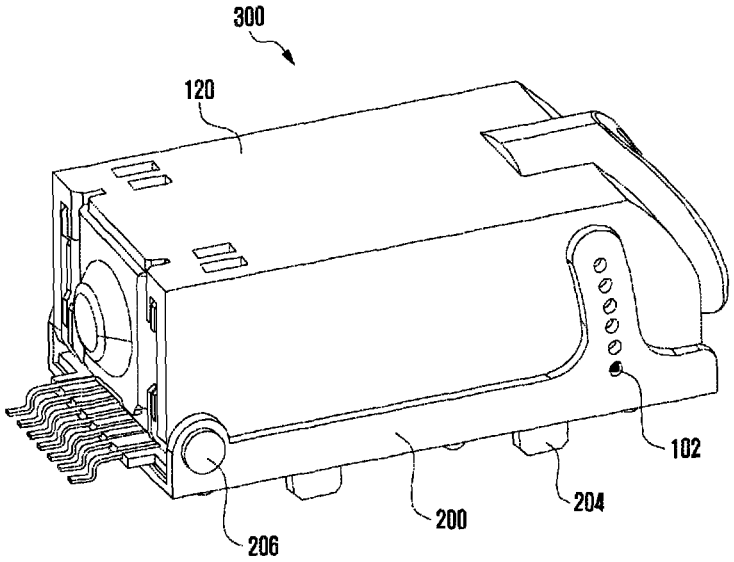


FIG. 12A

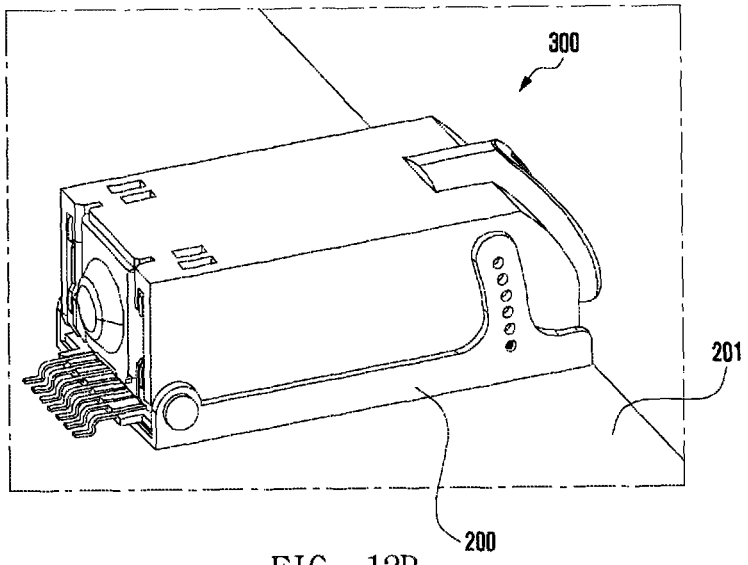


FIG. 12B

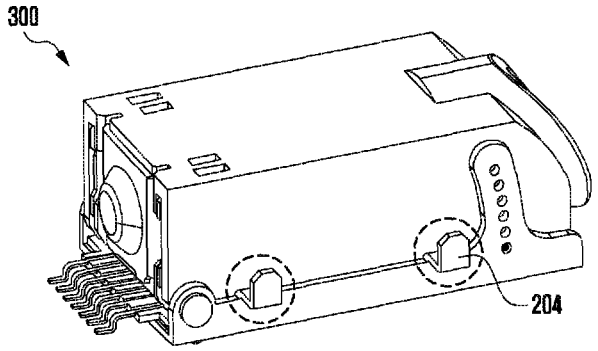


FIG. 13A

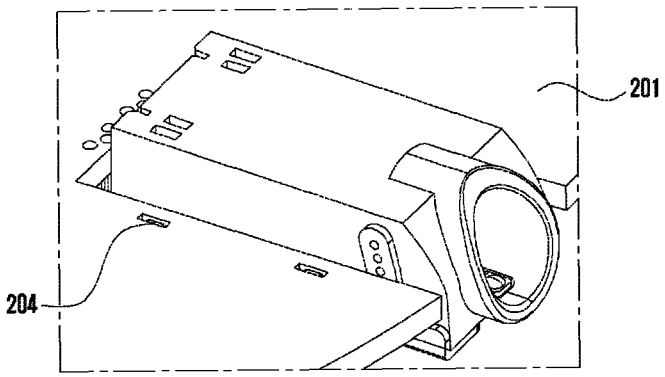


FIG. 13B

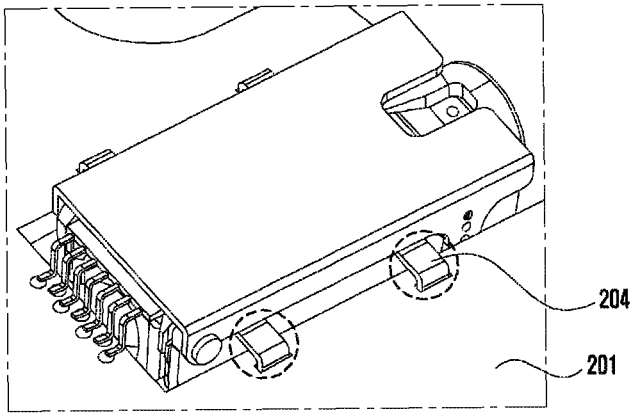
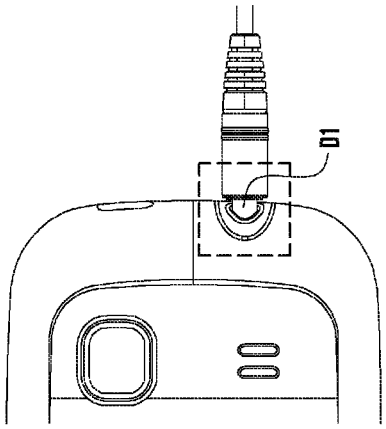


FIG. 13C



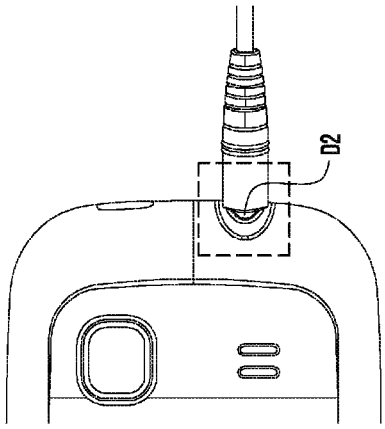
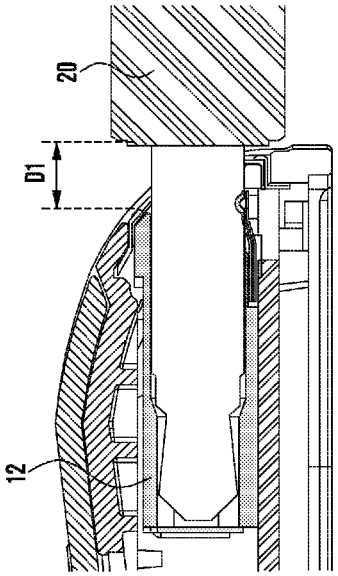


FIG. 14A



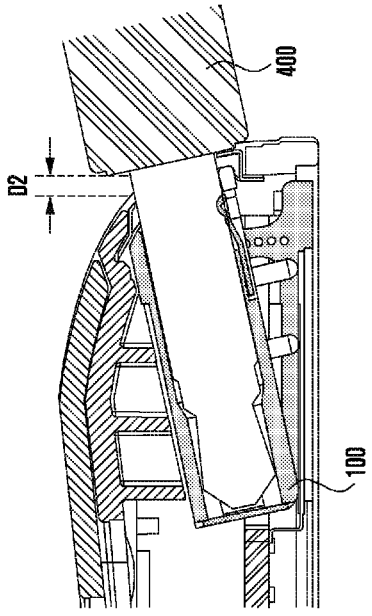


FIG. 14B

ANGLE ADJUSTABLE EAR JACK DEVICE

PRIORITY

This application claims the benefit under 35 U.S.C. §119(a) of a Korean patent application filed on Jun. 21, 2012 in the Korean Intellectual Property Office and assigned Serial No. 10-2012-0066818, the entire disclosure of which is hereby incorporated by reference.

BACKGROUND

1. Technical Field

The present disclosure relates to an ear jack device used in an electronic device. More particularly, the present disclosure relates to an angle adjustable ear jack device capable of adjusting an angle of the ear jack.

2. Description of the Related Art:

In order to make a sound or transmit sound to a user through an external speaker such as an earphone or a headphone instead of a built-in speaker in an electronic device, the electronic device requires an ear jack. Generally, the ear jack is a device for connecting a plug of an external device (e.g., an earphone) to the electronic device.

The plug is generally a metal portion for transmitting and receiving a sound signal and/or an electric signal between the electronic device and the earphone. For example, when the earphone plug is inserted into the ear jack, by contacting with the metal portion within the ear jack, the earphone plug transfers an electric signal including a sound signal of the electronic device to an earphone or transfers a sound signal and an electric signal of the earphone through, for example a built-in microphone of the earphone to the electronic device.

The metal portion for transferring an electric signal can be built into an ear jack by an insert injection method. There are two conventional methods of mounting an ear jack having the metal portion in a Printed Circuit Board (PCB). One is to use a Surface-Mount Device (SMD) and the other is to use a separate component like a Flexible Printed Circuit Board (FPCB).

FIGS. **1**A and **1**B are perspective views illustrating an ear jack mounted at one surface of a PCB by using the SMD according to the related art.

Referring to FIG. **1**A, once the conventional ear jack **12** is mounted in the PCB **10**, the conventional ear jack **12** cannot be moved in any direction because it is fixed to the PCB. Further, as shown in FIG. **1**B, the angle of an earphone plug **20** cannot be adjusted to correspond to a design shape or the external appearance of the electronic device. For instance, when the electronic device is designed as having a rounded-shape surface **30**, the earphone plug **20** is still horizontally inserted into the ear jack **12**. Even though the earphone plug **20** is completely inserted into the ear jack **12**, a portion of the earphone plug **22** remains exposed to the outside. Therefore, a user can misunderstand that the earphone plug **20** is not completely inserted into the ear jack **12** and thus the user may forcibly further push the earphone plug **20** into the ear jack **12**. As a result of the forcible insertion, components can be damaged and malfunction may occur.

FIGS. **2**A and **2**B are perspective views illustrating an obliquely mounted ear jack having a separate FPCB **14** according to the related art.

FIGS. **2**A and **2**B illustrate a state in which an insertion angle of the ear jack **12** is inclined to correspond to an external appearance or design (e.g., a rounded-shape surface design) of an electronic device as an alternative for addressing the problem described with reference to FIGS. **1**A and **1**B. However, because the ear jack **12** should be connected to the PCB **10** using a separate component like the FPCB **14**, this approach increases production costs and requires increased assembly time.

Therefore a need exists for an improved ear jack device capable of angle adjustment.

The above information is presented as background information only to assist with an understanding of the present disclosure. No determination has been made, and no assertion is made, as to whether any of the above might be applicable as prior art with regard to the present disclosure.

SUMMARY

Aspects of the present disclosure are to address at least the above-mentioned problems and/or disadvantages and to provide at least the advantages described below. Accordingly, an aspect of the present disclosure is to provide an angle adjustable ear jack device that can adjust the insertion angle of an earphone plug according to an external appearance design of an electronic device.

Another aspect of the present disclosure is to prevent components from being damaged and causing malfunctions as a result of unnecessary further forcible insertion.

Another aspect of the present disclosure is to provide an angle adjustable ear jack device that enhances the capability of component sharing and reducing production costs of the electronic device through standardization of an ear jack.

In accordance with an aspect of the present disclosure, an angle adjustable ear jack device is provided. The device includes an ear jack unit capable of an angle adjustment, an ear jack support unit for adjusting the angle of the ear jack unit, and at least one hinge for assembling the ear jack unit and the ear jack support unit.

In accordance with another aspect of the present disclosure, two or more fixing portions are positioned at both sides of the ear jack, and the fixing portion is bonded to an angle adjustment hole positioned at the ear jack support and fixes an angle of the ear jack.

In accordance with another aspect of the present disclosure, the conductive elastic member maintains a contact with the land pad, and the length of the conductive elastic member increases or decreases according to a change in an angle of the ear jack.

Other aspects, advantages, and salient features of the disclosure will become apparent to those skilled in the art from the following detailed description, which, taken in conjunction with the annexed drawings, discloses exemplary embodiments of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features, and advantages of certain exemplary embodiments of the present disclosure will be more apparent from the following detailed description in conjunction with the accompanying drawings, in which:

FIGS. **1**A and **1**B are perspective views illustrating an example of mounting an ear jack in one surface of a Printed Circuit Board (PCB) according to the related art;

FIGS. **2**A and **2**B are perspective views illustrating an example of obliquely mounting an ear jack to a Flexible Printed Circuit Board (FPCB) by using a separate FPCB according to the related art;

FIGS. **3**A and **3**B are perspective views illustrating an ear jack and a fixing portion according to an exemplary embodiment of the present disclosure;

FIG. **4** is a perspective view illustrating a conductive elastic member and a metal portion that transfer an electric signal to other devices or to a land pad according to an exemplary embodiment of the present disclosure;

FIG. **5** is a perspective view illustrating an ear jack unit in which an ear jack, a fixing portion, a conductive elastic member, and a metal portion are assembled together in relation to FIGS. **3**A and **3**B and FIG. **4** according to an exemplary embodiment of the present disclosure;

FIGS. **6**A and **6**B are perspective views illustrating a land pad and a contact land that transfer an electric signal of an ear jack to a PCB according to an exemplary embodiment of the present disclosure;

FIG. **7** is a perspective view illustrating an ear jack plate to be disposed at a PCB according to an exemplary embodiment of the present disclosure;

FIG. **8** is a perspective view illustrating an ear jack support unit in which an ear jack plate and a land pad are assemble together in relation to FIGS. **6**A and **6**B and FIG. **7** according to an exemplary embodiment of the present disclosure;

FIGS. **9**A and **9**B are exploded perspective views illustrating an ear jack unit and an ear jack support unit assembled by a hinge in relation to FIG. **3**A to FIG. **8** according to an exemplary embodiment of the present disclosure;

FIG. **10** is a perspective view illustrating an angle adjustable ear jack device in which an ear jack unit and an ear jack support unit are assembled in relation to FIGS. **9**A and **9**B according to an exemplary embodiment of the present disclosure;

FIGS. **11**A to **11**C are cross-sectional views illustrating change in an angle of an angle adjustable ear jack device mounted in a PCB according to an exemplary embodiment of the present disclosure;

FIGS. **12**A and **12**B are perspective views illustrating an angle adjustable ear jack device in an on-board type according to an exemplary embodiment of the present disclosure;

FIGS. **13**A to **13**C are perspective views illustrating an angle adjustable ear jack device mounted in a PCB-cutting type according to an exemplary embodiment of the present disclosure; and

FIGS. **14**A and **14**B are cross-sectional views and plan views comparing an exposure level of an earphone plug after insertion according to an exemplary embodiment of the present disclosure.

Throughout the drawings, it should be noted that like reference numbers are used to depict the same or similar elements, features, and structures.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

The following description with reference to the accompanying drawings is provided to assist in a comprehensive understanding of exemplary embodiments of the disclosure as defined by the claims and their equivalents. It includes various specific details to assist in that understanding but these are to be regarded as merely exemplary. Accordingly, those of ordinary skill in the art will recognize that various changes and modifications of the embodiments described herein can be made without departing from the scope and spirit of the disclosure. In addition, descriptions of well-known functions and constructions may be omitted for clarity and conciseness.

The terms and words used in the following description and claims are not limited to the bibliographical meanings, but, are merely used by the inventor to enable a clear and consistent understanding of the disclosure. Accordingly, it should be apparent to those skilled in the art that the following description of exemplary embodiments of the present disclosure is provided for illustration purpose only and not for the purpose of limiting the disclosure as defined by the appended claims and their equivalents.

It is to be understood that the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise. Thus, for example, reference to "a component surface" includes reference to one or more of such surfaces.

Technical features disclosed herein in connection with an angle adjustable ear jack device of exemplary embodiments of the present disclosure can be applied to any connector device for connecting a peripheral or external device to a host device.

For conciseness of explanation, the following exemplary embodiments illustrate an earphone plug, however, the scope of the present disclosure is not limited to the earphone plug and can be applied to entire devices having a plug that can transmit and receive a sound signal and/or an electric signal with the ear jack.

Further, a shape of components including an ear jack unit, an ear jack support unit, a fixing portion, and a hinge used in exemplary embodiments of the present invention are merely exemplary, and thus the present disclosure is not limited thereto.

FIGS. **3**A and **3**B are perspective views illustrating an ear jack and a fixing portion according to an exemplary embodiment of the present disclosure.

Referring to FIGS. **3**A and **3**B, in the ear jack **100**, at least two fixing portions **102** are installed at both side of the ear jack **100**. The fixing portion **102** is used for fixing an angle of the ear jack **100** according to an external appearance or design of an electronic device. A position of the fixing portion **102** is not limited to one location of the ear jack **100** and may be changed to, or positioned at, various locations as needed.

Further, the fixing portion **102** may comprise various fixing members including a pogo pin. Further, the shape of the fixing portion **102** is not limited to the shape described in FIGS. **3**A and **3**B. In exemplary embodiments, a variety of shapes can be used.

FIG. **4** is a perspective view illustrating a conductive elastic member and a metal portion that transfer an electric signal to other devices or to a land pad according to an exemplary embodiment of the present disclosure.

Referring to FIG. **4**, the conductive elastic member **106** and the metal portion **104** shown in FIG. **4** can be housed within the ear jack by an insert injection molding method. The conductive elastic member **106** includes a pogo pin and may be formed with various members having conductivity and an elastic force. The length of the conductive elastic member **106** increases or decreases according to change in a pressure and/or an angle applied to the ear jack **100**.

FIG. **5** is a perspective view illustrating an ear jack unit in which an ear jack, a fixing portion, a metal portion, and a conductive elastic member are assembled together in relation to FIGS. **3**A and **3**B and FIG. **4** according to an exemplary embodiment of the present disclosure.

Referring to FIG. **5**, the fixing portion **102**, the metal portion **104**, and the conductive elastic member **106** can be housed in the ear jack **100** of the ear jack unit **120** by using an insert injection molding method.

FIGS. **6**A and **6**B are perspective views illustrating a land pad and a contact land that transfer an electric signal of the ear jack to a Printed Circuit Board (PCB) according to an exemplary embodiment of the present disclosure.

Referring to FIGS. **6**A and **6**B, a contact land **210** for maintaining a contact with the conductive elastic member **106** in relation to FIG. **5** is shown. The land pad **208** shown in FIG. **6**A performs a function of transferring an electric signal of the ear jack unit **120** to the PCB or transferring a sound signal and/or an electric signal generated in an electronic device to the ear jack unit **120** shown in FIG. FIG. **5**. The land pad **208** includes a plurality of contact lands **210**.

Referring to FIG. **6**B, the conductive elastic member **106** housed in the ear jack **100** maintains contact with the contact land **210** even if an angle of the ear jack unit **120** is changed. In order to maintain the contact with the conductive elastic member **106**, the contact land **210** may have a characteristic of being extended in a lengthwise direction. When an angle of the ear jack unit **120** is changed, the length of the conductive elastic member **106** may increase or decrease. Contact of the elastic member **106** and the contact land **210** moves in a direction depicted by the arrow shown in FIG. **6**B, thereby maintaining a stable and continuous contact between the conductive elastic member **106** and the contact land **210**.

FIG. **7** is a perspective view illustrating an ear jack plate to be disposed at a PCB according to an exemplary embodiment of the present disclosure.

Referring to FIG. **7**, the ear jack plate **200** is generally made of a Sustain (SUS) press with a metal material and corresponds to a frame in which the ear jack unit **120** is assembled. The ear jack plate **200** may have at least one mounting portion **204** that would be used to mount the ear jack plate in the PCB using a Surface Mount Device (SMD). The position and shape of the mounting portion **204** may be changed according to a type (e.g., on-board or pc-cutting type) as described later. Further, the ear jack plate **200** may have an angle adjustment hole **202** for adjusting an angle of the ear jack unit **120** by bonding to the fixing portion **102** positioned at both side of the ear jack **100**. A distance, a size, and the number of the angle adjustment hole **202** may be changed according to a product. The shape of the adjustment hole is not limited to the shape described in FIG. **7**. Its shape can be modified in accordance with the shape of the fixing portion **102**.

FIG. **8** is a perspective view illustrating an ear jack support unit in which an ear jack plate and a land pad are assemble together in relation to FIGS. **6**A and **6**B and FIG. **7** according to an exemplary embodiment of the present invention.

Referring to FIG. **8**, ear jack plate **200** of ear jack support unit **220** and land pad **208** are shown as assembled according to an exemplary embodiment of the present disclosure.

FIGS. **9**A and **9**B are exploded perspective views illustrating an ear jack unit and an ear jack support unit assembled by a hinge in relation to FIGS. **3**A to FIG. **8** according to an exemplary embodiment of the present disclosure.

Referring to FIGS. **9**A and **9**B, the hinge **206** functions as a rotation axis when an angle of the ear jack unit **120** is changed. When the ear jack unit **120** and the ear jack support unit **220** are assembled, the hinge **206** is inserted into a hinge hole **108** of the ear jack unit **120**.

FIG. **10** is a perspective view illustrating an angle adjustable ear jack device in which an ear jack unit and an ear jack support unit are assembled in relation to FIGS. **9**A and **9**B according to an exemplary embodiment of the present disclosure.

Referring to FIG. **10**, the ear jack unit **120** and the ear jack support unit **220** are coupled by the hinge **206**, and the fixing portion **102** is bonded to the angle adjustment hole **202** of the ear jack plate **200** having mounting portion **204**.

FIGS. **11**A to **11**C are cross-sectional views illustrating change in an angle of the angle adjustable ear jack device mounted in a PCB according to an exemplary embodiment of the present disclosure.

FIG. **11**A illustrates an angle adjustable ear jack device **300** mounted in a PCB **201** in a horizontal state. FIG. **11**B illustrates an ear jack unit **120** with an angle R**1** compared with FIG. **11**A. FIG. **11**C illustrates the ear jack unit **120** with an increased angle R**2** compared with FIG. **11**B.

Referring to FIGS. **11**A to **11**C, the ear jack unit **120** rotates in a center of the hinge **206** of the ear jack plate **200**. The fixing portion **102** fixes an angle of the ear jack unit **120** by bonding to the angle adjustment hole **202** in correspondence with the angle (e.g., R**1** and R**2**). In comparison with FIG. **11**A, FIG. **11**B shows the angle adjustable ear jack device with a certain angle (R**1**). The fixing portion **102** is bonded to an angle adjustment hole which is different from the adjustment hole depicted in FIG. **11**A. FIG. **11**C illustrates an exemplary embodiment that has a bigger angle (R**2**) than the angle R**1** in FIG. **11**B. The fixing portion **102** is bonded to a different angle adjustment hole in correspondence with the angle R2.

Further, FIGS. **11**A to **11**C also illustrate change in the length of the conductive elastic member **106** in accordance with the angle change of the ear jack unit **120** according to exemplary embodiments of the present disclosure. The conductive elastic member **106** continues to maintain a contact with the contact land **210**. When an angle of the ear jack unit **120** changes from R**2** to R**1**, the length of the conductive elastic member **106** may decrease in accordance with the angle change.

FIGS. **12**A and **12**B are perspective views illustrating an angle adjustable ear jack device mounted in an on-board type according to an exemplary embodiment of the present disclosure.

Referring to FIGS. **12**A and **12**B, an exemplary angle adjustable ear jack device **300** is described below in connection with FIGS. **13**A to **13**C.

FIGS. **13**A to **13**C are perspective views illustrating an angle adjustable ear jack device mounted in a PCB-cutting type according to an exemplary embodiment of the present disclosure.

Referring to FIGS. **12**A and **13**A to **13**C, when comparing FIG. **12**A and FIG. **13**A, the positions and shapes of the mounting portion **204** are different. That is, a method of mounting the angle adjustable ear jack device **300** in the PCB **201** may vary depending on the design and thickness of an electronic device. In this case, a position and a shape of the mounting portion **204** may be changed according to a method of mounting the angle adjustable ear jack device **300** in the PCB **201**. FIG. **13**B illustrates an example of a PC-cutting type that positions the angle adjustable ear jack device **300** in between the PCB by cutting a specific portion of the PCB **201**. FIG. **13**C illustrates a rear view of the PCB where the angle adjustable ear jack device **300** mounted in the PC-cutting type. In exemplary embodiments, the method of mounting in the PCB **201** of the angle adjustable ear jack device **300** is not limited to the on-board and PC-cutting type.

FIGS. **14**A and **14**B are cross-sectional views and plan views comparing an exposure level of an earphone plug after insertion according to an exemplary embodiment of the present disclosure.

Referring to FIG. **14**A, an earphone plug exposure D**1** exposed to the outside when the earphone plug **20** is inserted into the conventional jack **12** is shown. FIG. **14**B shows an earphone plug exposure D**2** exposed to the outside when an earphone plug **400** is inserted into the angle adjustable ear

jack device **300** according to an exemplary embodiment of the present disclosure. Referring to FIG. **14**B, when the angle adjustable ear jack device **300** is used, a mounting angle of the ear jack **100** may be adjusted to correspond to an external appearance design (e.g., a rounded surface design) of an electronic device, thereby minimizing the amount of the earphone plug exposure exposed to the outside.

Therefore, exemplary embodiments of the present disclosure prevent a user's misunderstanding that the earphone plug **400** is not completely inserted into the ear jack **100**. Consequently, it can prevent components from being damaged and malfunction from occurring as a result of the forcible insertion.

According to exemplary embodiments of the present disclosure, by adjusting an angle of an ear jack through an ear jack device, an ear jack component may be standardized, and sharing of the ear jack can be enhanced. Further, by using one type of ear jack device in electronic devices having various designs, and without changing the ear jack according to an external appearance or design (e.g., a curved surface design) of an electronic device, the mounting ability of the ear jack may be enhanced and production costs may be reduced.

While the disclosure has been shown and described with reference to certain exemplary embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the disclosure as defined by the appended claims and their equivalents.

What is claimed is:

1. An angle adjustable ear jack device, the device comprising:

an ear jack unit capable of an angle adjustment and comprising an ear jack, a conductive elastic member and a metal portion;

an ear jack support unit for adjusting the angle of the ear jack unit; and

at least one hinge for assembling the ear jack unit and the ear jack support unit,

wherein the length of the conductive member increases or decreases according to change in a pressure and/or an angle applied to the ear jack.

2. The device of claim **1**, wherein the conductive elastic member maintains contact with a land pad.

3. The device of claim **1**, wherein the conductive elastic member transfers and receives an electric signal between the ear jack unit and an external device.

4. The device of claim **1**, wherein the conductive elastic member includes a pogo pin.

5. The device of claim **1**, wherein the ear jack unit further includes a fixing portion positioned at a side of the ear jack.

6. The device of claim **5**, wherein the fixing portion is configured to fix the angle of the ear jack unit in association with an angle adjustment hole of an ear jack plate.

7. The device of claim **5**, wherein the fixing portion includes a pogo pin.

8. The device of claim **1**, wherein the ear jack support unit comprises an ear jack plate and a land pad.

9. The device of claim **8**, wherein the ear jack plate includes a plurality of angle adjustment holes.

10. The device of claim **9**, wherein the plurality of angle adjustment holes are configured to adjust the angle of the ear jack by bonding a fixing portion of the ear jack unit to at least one of the plurality of the angle adjustment holes.

11. The device of claim **8**, wherein the ear jack plate has at least one mounting portion for mounting the ear jack plate in a Printed Circuit Board (PCB).

12. The device of claim **11**, wherein the mounting portion mounts the ear jack plate in the PCB using a Surface Mount Device (SMD).

13. The device of claim **11**, wherein the at least one mounting portion changes a position and a shape according to a type.

14. The device of claim **12**, wherein the type includes an on-board type and a PCB-cutting type.

15. The device of claim **8**, wherein the land pad transfers the electric signal of the ear jack unit to the PCB or to a plug of an external device.

16. The device of claim **8**, wherein the land pad includes a plurality of contact lands.

17. The device of claim **16**, wherein the plurality of contact lands make contact with the conductive elastic member, the contact lands being formed in a plug insertion direction in order to maintain the contact with the conductive elastic member even when the angle of the ear jack unit is changed.

18. The device of claim **1**, wherein the at least one hinge functions as a rotation axis when the angle of the ear jack unit is adjusted.

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